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Variational modelling of nonlinear water waves ANNA KALOGIROU, ONNO BOKHOVE, University of Leeds — Mathematical modelling of water waves is demonstrated by investigating variational methods. A potential flow water wave model is derived using variational techniques and extented to include explicit time-dependence, leading to non-autonomous dynamics. As a first example, we consider the problem of a soliton splash in a long wave channel with a contraction at its end, resulting after a sluice gate is removed at a finite time. The removal of the sluice gate is included in the variational principle through a time-dependent gravitational potential. A second example involving non-autonomous dynamics concerns the motion of a free surface in a vertical Hele-Shaw cell. Explicit time-dependence now enters the model through a linear damping term due to the effect of wall friction and a term representing the motion of an artificially driven wave pump. In both cases, the model is solved numerically using a Galerkin FEM and the numerical results are compared to wave structures observed in experiments. The water wave model is also adapted to accommodate nonlinear ship dynamics. The novelty is this case is the coupling between the water wave dynamics, the ship dynamics and water line dynamics on the ship. For simplicity, we consider a simple ship structure consisting of V-shaped cross-sections.

Anna Kalogirou
University of Leeds

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